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GEOLOGICAL MAPPING METHODS BY THE PHILIPPINE BUREAU OF MINES

By ELPIDIO C. DE VERA,
Assistant Director

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GEOLOGICAL MAPPING METHODS BY THE PHILIPPINE BUREAU OF MINES

Elpidio C. Vera, Assistant Director

(1) The Republic of the Philippines, through the Bureau of Mines, continues its efforts to obtain geological information and determine the mineral potential of the country. The present policy is to increase the tempo of mapping activity with emphasis on: (a) Regional reconnaissance mapping to establish the guiding system that will provide a basis for segregating priority areas as well as extrapolation of potential zones; (b) Semi-detailed mapping to decide on whether or not to go through the more costly and time-consuming detailed survey; to publicize mineral areas attractive for investment; and in the field of engineering, to provide substantial guarantee on the feasibility and safety of erecting structures on the area; (c) Detailed mapping to help implement selected engineering projects or economic projects of the government and assist private parties or companies in the development of mineral prospects. Spot investigation mapping is also being maintained as a technical public service.

Regional Reconnaissance Mapping

(2) Regional reconnaissance mapping in the Philippines was started in 1939 under the management of the National Development Company.[1] It was conducted specifically to investigate oil possibilities and was limited to areas occupied by thick Middle Tertiary to Quaternary sediments. Field work was done on a contract basis by a group of American geologists over a period of one and a half years. The procedure consisted of making a careful study of several selected sections to establish stratigraphic faunal control and for subsequent reference. The scale of mapping varied from 1:20,000 to 1:50,000 and a base map in the scale of 1:200,000 was used in the presentation of the report.

(3) The Bureau of Mines made efforts to start reconnaissance geological mapping in 1947 but primarily on areas reported to have mineral potentiality with the aim of accelerating the growth of local industry. It was handicapped by the lack of precise base maps, few experienced men and difficulty of mobility. In addition, there was a necessity of building stratigraphic control concurrently with the progress of mapping. Survey work was generally carried on foot. The scale of base maps used was generally 1:25,000. An annual coverage of about 2,500 square kilometers was made which increased steadily to about 4,000 sq. kms. in 1954. With the availability of precise base maps from Washington, D.C., U.S.A. in the scale 1:50,000 time loss in the base map preparation was eliminated, and with the acquisition of jeeps for the survey and increase in fieldmen, the rate of mapping was gradually accelerated to as much as 5,420 sq. kms. in 1959. The scales of 1:25,000 and 1:50,000 of base maps were used.

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1 A government corporation created in 1911 to further the economic policy of the Philippine Commonwealth.

Need for Revising the Method

(4) The rate of mapping up to 1959 still proved very unsatisfactory as the total coverage till then was only 10% of the 297,500 square kilometers total land area of the Philippines. To survey the remaining areas at that rate excluding those reliably mapped by petroleum companies would require around 40 to 50 years more. In addition, as formational segregation was used in the old procedure and various names were introduced on lithology from island to island, considerable confusion arose in correlation. This is especially true in the lithologic sequence of the lower Tertiary and older, where paleontological evidences are scanty. The need for a change, therefore, was very much felt if it had to establish a regional geologic map in the shortest time possible so as to provide a guiding system, segregate priority areas that can bring about immediate economic returns and provide sound basis to extrapolate potential zones.

(5) Basically, therefore, the revision of our mapping is guided by the followings

(a) To substantially reduce foot work and at the same time maintain precision, and

(b) Benefiting from already established stratigraphic controls, to segregate the lithology by time-rock units to minimize difficulty in correlation.

Present Method

(6) The present method of regional reconnaissance mapping designed to produce a complete geologic map of the Philippines by 1965 consists essentially of the following steps, in addition to the standard operational procedure.[2]

(a) Preliminary photogeologic interpretation and planning of field traverses;

(b) Foot traverses are done only on selected lines and readily accessible areas and field parties are mechanized to expedite movement;

(c) With proper field controls, photogeologic interpretations are checked and readjusted. In general, delimitation of structures and lithologic boundaried are done by photogeology.

(7) The geologic map worksheets are in the scale of 1:50,000 and compilation is done on 1:250,000 scale.

Pending Problems

(8) With ten parties assigned in regional mapping the program is beset with problems in the completion and finalization of the work into publication. In order to remedy the situation it is desired (a) to increase laboratory facilities and

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2 Standard mapping procedure in this country consists of making field traverses, commonly along creek beds. Rock formations are studied and sampled. Geologic structures are measured by use of brunton compass and are located with the use of base maps in the scale of 1:50,000. Geologic notes are recorded on field books. Samples collected are indexed and further studied in the camp and later sent to the central office laboratories for additional study either petrographically, paleontologically or chemically.

technicians, and to introduce the method of absolute age determination; (b) to establish regional laboratories to facilitate study of the collected samples; (c) to furnish each field party with a petrographic microscope; (d) to provide good working space for geologists; (e) to increase efficiency in writing reports; (f) extend generous library facilities; (g) in the case of fieldwork, there is need for simplification in the procurement of equipment and supplies, and disbursement of field expenses; (h) secure technicians to specialize in modern map preparation and reproduction processes.

Semi-detailed Mapping (Present state)

(9) Semi-detailed mapping is carried out only on specific areas such as (a) those segregated by regional reconnaissance to be prospective for mineral deposits; (b) abandoned mineral prospects and mine areas to determine the feasibility of resuming exploration and exploitation; (c) sites selected for major engineering projects; and (d) areas of scientific interest.

(10) The work as carried out is presently divided under four groups: (a) survey of metallic deposits, (b) survey of non-metallic deposits, (c) engineering geology and geohydrological survey, (d) geophysical and geochemical surveys.

(11) The first two groups follow practically the standard procedure of reconnaissance work except that traverses are spaced more closely to insure precision in the projections of geologic structures. In addition, calculations of geological reserves are made. Base maps are prepared by enlarging the 1:50,000 photogrammetrically prepared topographic maps by U.S. Army Engineers supplied to the Philippine government to a scale of 1:10,000 greater or less, but in no case smaller than 1:25,000. Sketches of the outcrops of the deposits are done in a larger scale, enough to accommodate valuable geologic data. Traverses are usually controlled by the tape and compass method. Depending on the nature of the problem this survey oftentimes becomes nearly detailed in nature.

(12) The other two groups are still limitedly applied at present. Airborne magnetometer survey has been run in a few places which are deemed potential for iron deposits while ground magnetometer survey is being continually tested and the process of training technicians is still going on. Geochemical prospecting was tested in 1960 and is now being applied in a regional scale in stream sediments and waters in mineralized regions.

Problems of Semi-detailed Mapping

(13) The Philippines is passing through a phase of rapid evolution from a state of economic attachment and dependency on the United States to one of economic independence. The growing need for this survey had been felt in the past and is expected to grow much more rapidly especially after the preliminary regional reconnaissance is completed. The fields of geophysics and geohydrological engineering are equally expected to play an important role in the location of sources of ground water. The numerous newly established factories and increase of urban population would considerably aggravate shortage of industrial and domestic water supply. The growing scantiness of surface deposits may soon require considerable reliance on geophysics and geochemistry. These problems must be solved at the earliest time possible.

Detailed Mapping

(14) Detailed geological survey is a country-wide concern of many private companies. The Bureau of Mines limits this survey primarily to known mineral deposits and mineral reservations and only occasionally assists in the geological study of operating mines. Detailed mapping is also conducted to investigate foundation conditions, sometimes to determine the availability of construction materials

in selected sites of major engineering projects.

(15) The survey is usually divided into two stages; (a) Preliminary investigation stage, and (b) exploration stage.

(16) The preliminary investigation stage is essentially surface geological mapping in which plane table is used to make a precise topographic map and to locate accurately observable geologic features. The general geologic map commonly ranges in scale from 1:1,000 to 1:5,000. Critical areas and exploration openings are mapped in a larger scale to permit accommodation of many details. The subsurface explorations performed at this stage are of the simple types as test pitting, trenching and dogholes and their adoption depends on the characteristics of the area. Where outcrops are wanting, more elaborate test pitting and trenching are done. The exploratory openings are studied and logged. The final study includes making of geologic sections and planning for systematic exploration.

(17) The second stage of detailed mapping operation is performed only on very limited projects that require thorough exploration or evaluation. This is usually conducted by resident geologists assigned to the projects, who further map new openings and log drilled cores, new test pits, tunnels, etc., and subsequently recommend either changes in work, remedial measures or termination of exploration work depending on their findings. In the case of mineral deposits, evaluation and computation of ore reserves are done.

(18) Geophysical methods are still rarely used. In cases where applied (ground magnetometer and geochemical), grid lines and stations are plotted by plane table survey.

Problems of Detailed Mapping

(19) The preparation of large scale topographic maps for detailed mapping often consumes considerable time and man-hours. The present available 1:50,000 topographic map sheets are not accurate enough for the purpose. In this consideration, plans are being made to secure low altitude photographs and to prepare by multiplex methods accurate large scale topographic maps. This can be used to upgrade the accuracy of semi-detailed and spot investigation surveys.

(20) Another problem being considered is in the field of mineral resources development. Outcrops and near-surface deposits are rapidly getting so scarce that future surface geological mapping may not be enough guarantee for immediate capital investment. It is desired to start an early expansion of the present geophysical and geochemical staff to give ample time for their training, development and adjustment of methods adaptable to local conditions.

(21) In the field of geohydrological engineering, detailed mapping and geophysical methods are very likely to be employed soon, as is being done at present in more advanced countries. The training of men to conduct such surveys is very much desired to be started at present. In addition map reproduction processes have to be updated.

Spot Investigation

(22) Spot investigation survey is a form of technical service extended to the public, private companies and/or government entities needing rough geological information or evaluation on specific areas. This survey covers a very broad field of study, running from strictly economic geology in nature to engineering geology and water supply problems. Sometimes, to investigate protests of citizens against mining companies regarding river pollution; to locate good sources of underground

water for industrial uses; to determine causes of landslides or other forms of mass wasting and to suggest remedial measures. In such cases the problems are unpredictable, even the locality may be uncertain.

(23) As the nature of the problem requires immediate decisions, the Bureau assigns this type of survey only to capable geologists of long experience. The methods used vary, sometimes unconventional and unique, depending a great deal on the nature of the problem and the needed answer of the requesting party. However, ordinarily the geologist conducting spot investigations carries with him the standard geologist's tools plus tape and altimeter. Base maps in the scale of 1:50,000 are used and large scale maps are done only as sketches. Laboratory study may or may not be required.

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